A Área de Diagnóstico por Imagem marcou presença no European Congress of Radiology, que decorreu em Viena de Áustria de 4 a 8 de Março.

Técnicos e Médicos dos diferentes Pólos do CHLC, assinalaram a sua presença com apresentações de comunicações e posters em representação da Área.

Atendendo à qualidade do programa científico e à mais valia que foi a frequência de cursos e a participação em sessões científicas, não poderíamos deixar de partilhar este momento que foi para todos nós mais que uma simples aprendizagem, um complemento que contribuirá para ampliar o conhecimento das diferentes vertentes que constituem a Institucional numa perspectiva de optimizar e melhorar as nossas práticas. A formação apesar do seu retorno personalizado é sempre institucional, pois as Instituições são as pessoas e o valor acrescido que estas representam para a organização e se reflecte nos serviços que se presta.

Nesta Edição Especial ECR, apresentamos uma selecção de alguns dos muitos temas abordados, esperando que espelhe desde logo a reflexão da prática do que foi aprendido na Academia.

Cristina Almeida
Técnica Coordenadora da ADPI

Cardiac Computed Tomography dose levels: a national approach and comparison with other cardiac radiation procedures

Authors: Daniela Vicente (1), Vanessa Dessandier (1), Andrea Pimenta (1), Cristina Almeida (3), Duarte Silva (4), Rosa Gaspar (5), Graciano Paulo (6), Joana Santos (7)

Purpose: The aim of this study is to obtain Portuguese cardiac Computed Tomography (CT) Diagnostic Reference Levels (DRLs) and compare the effective dose values with other cardiac examinations performed in Portugal and international studies.

Methods: CT dose values and chest anteroposterior diameter (direct measurement on the images) were retrospectively collected in four centres of excellence representing different regions of Portugal, in order to calculate the DRLs based on the 75th percentile CT values.

Results: The sample was composed by 108 individuals, without significant differences in chest diameter. Significant differences were found between local DRL’s across the centres. The proposed DRL for cardiac CT is 32mGy. The obtained cardiac CT effective dose value is higher than a diagnostic angiography and similar to a cardiac angioplasty.

Conclusions: The obtained dose values should be optimised. Procedures justification must be reconsidered and the radiation examinations risk must be analysed taking into account the clinical indications.
Is cerebral angiography still performed in children? 
A review of current indications

Authors: Isabel Fragata, Mariana Diogo Jaime Pamplona, Tiago Baptista, Carla Conceição, João Reis

Purpose: To review current indications for performing conventional cerebral angiography in the pediatric population. To evaluate the rate of complications for diagnostic and therapeutic angiography in children.

Background: Conventional cerebral catheter angiography is increasingly being replaced by non-invasive vascular imaging methods. In the pediatric population, where radiation and contrast are a concern, catheter angiography is seldom performed, and has few indications, usually whenever endovascular intervention is necessary.

Imaging findings: We retrospectively reviewed our neurointervention department database from 2012 to 2014, and collected the total number of patients under 18 years old that had cerebral angiograms. We found a total of 30 patients, ages ranging from 4 months to 17 years old. Indications for cerebral angiogram were arterio-venous malformations (27%), cerebral aneurysms (17%), facial vascular malformation (10%), vasculitis (10%), carotid-cavernous fistula (6,7%), vein of Galen Malformation (6,7%), cranial aneurysmal bone cyst (6,7%), and finally tumor embolization, petrous sinus venous sampling, venous thrombosis and acute stroke (3% each). A third of the patients had endovascular procedures in our series. No intra-procedural complication was noted. One patient had intracranial hemorrhage 2 hours after embolization of a vein of Galen malformation, secondary to probable venous occlusion, but recovered clinically. There were no other significant complications.

Conclusion: Catheter cerebral angiography has selected indications in the pediatric population. Arteriovenous malformations and cerebral aneurysms were the main indications in our series, and served mainly for treatment planning. Catheter cerebral angiography is safe to perform in children, and provides important diagnostic information on cerebrovascular pathology. There are formal indications for endovascular treatment in children, such as vein of Galen malformation.

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Frequency and dose levels of paediatric image guide fluoroscopy procedures in Portugal

Authors: Diana Almeida (1), Núria Carvalho (1), Bruno Esteves (2), Cristina Almeida (3), Graciano Paulo (4), Joana Santos (5)

Purpose: Establish national Diagnostic Reference Levels (DRLs) for the most common paediatric fluoroscopic procedures based on the 75\textsuperscript{th} percentile value of Dose Area product (DAP), per age categorisation in the two exclusively paediatric national hospitals.

Materials and Methods: Digital Imaging and Communications in Medicine (DICOM) headers for brain, digestive, urological and orthopaedic fluoroscopy procedures performed during 2013 were analysed and compared with literature.

Results: The most common procedures were urological (36%) and digestive (34%). The dose values obtained for the age groups of [0,1], [1,5], [5,10], [10,15] and ≥15 were 338, 304, 430, 380 and 390cGy.cm\textsuperscript{2} for urological studies and 480, 559, 530, 560 and 415cGy.cm\textsuperscript{2} for digestive studies, respectively.

Conclusions: The exposure values obtained in this study are heterogeneous across the age groups and intuitions. To reduce these differences optimisation procedures are needed in order to reduce the risk of radio-induced pathology in children.
Interventional Neuroradiology procedures: patient and staff dose levels

Authors: Isabel Cardoso (1), Sara Pereira (1), Cristina Almeida (2), Joana Santos (3), Graciano Paulo (4)

Purpose: Establishment of local diagnostic reference levels (DRLs) in neuroradiology interventional procedures and evaluation of the occupational exposure using real-time active dosimeters in a Portuguese excellence department.

Material and Methods: This study was conducted in two phases: a retrospective dose data collection of the 2013 neuroradiology procedures in order to establish local DRLs, based on the 75th percentile of the dose descriptors; and a prospective data collection of staff exposure during 41 procedures using Raysafe i2 real-time dosimeters.

Results: The most frequently performed procedures were cerebral embolization (20%), cerebral angiography (19%) and interventional spine procedures (16%). The obtained local DRLs were 135Gy.m$^2$, 62Gy.cm$^2$ and 37Gy.cm$^2$ respectively. During the 41 procedures, the neuroradiologist was exposed to an average of 49µSv and the nurse to 8µSv. The anaesthetist was the less exposed.

Conclusion: This study was pioneer in Portugal. The staff was unaware of the exposure values and this study contributed to change their radiation protection practices. The obtained patient and staff dose were similar to the literature.

The influence of isocenter gantry patient positioning for paediatric head CT examinations in eye lens dose, using in-plane vinyl bismuth and barium shielding

Authors: Flor Pereira (1), Filipa Carvalho (1), Magda Malva (2), Graciano Paulo (3), Joana Santos (4)

Purpose: Evaluate the influence of isocenter gantry patient positioning in eye lens dose, during paediatric head Computed Tomography (CT) examinations using bismuth and barium shielding.

Materials and methods: Head CT examinations were performed in axial mode with and without in-plane shielding (vinyl bismuth and barium) in a anthropomorphic paediatric phantom (ATOM-705) with three different patient positioning (head isocenter, 4cm anterior and posterior). Eye lens dose was measured with Unfors Patient Skin Dose and CT dose was obtained from the dose report. To compare image noise three Regions Of Interest (ROI-1cm$^2$) per CT examination (orbits, periphery and central) were analysed using RadiAnt DICOM Viewer (64-bit) software.

Results: CT dose levels decreased with anterior centring however eye lens dose increased. The higher eye lens dose reduction (29-33%) was obtained using bismuth protection. The impact on image noise was similar for both shielding, affecting exclusively the periphery.

Conclusions: The best dose and image quality combination was obtained in gantry isocenter using tube current and tube voltage modulation.
CT evaluation of small bowel carcinoid tumors

Authors: Nuno Costa, Tiago Bilhim, L. Nascimento

Learning objectives: To review, describe and illustrate the spectrum of imaging findings of small bowel carcinoid tumors (SBCT) using abdominal computed tomography (CT) scan. Elucidate the most common appearances of SBCT liver metastases on CT images.

Background: SBCT are rare neuroendocrine neoplasms that constitute nearly 2% of all gastrointestinal tumors. Approximately 85% of carcinoid tumors arise in the gastrointestinal tract. They are the most common primary small bowel cancer. Since it's a slow growing tumor, most are small (few centimeters) when detected and they can be difficult to be seen in routine CT scans and even at surgery. In 40 to 80% of the cases there can be a secondary mesenteric involvement. Although we cannot always see the primary tumor in the small bowel wall, CT is still a very important technique to show the mesenteric extension of the tumor, to detect the liver metastases and to guide the percutaneous biopsy if indicated. The sensitivity of CT scan is reported to be around 80%.

Except in carcinoid syndrome (10%), the symptoms are usually vague and the diagnosis is delayed until the imaging procedures.

Findings and procedure details: In case of clinical suspicion of SBCT we perform multidetector CT with multiplanar reconstructions using oral and i.v. (120 mL injected at 2-3 mL/sec) nonionic iodinated contrast. We acquire dual-phase images during arterial and venous times.

We reviewed retrospectively all the 21 cases of SBCT with available CT scans at our institution during the period of April 2011 to April 2014. CT scans were evaluated for size, margins, density, small bowel wall thickening, radiating strands, calcifications, mesenteric vessels and local lymph-nodes size.

The patients study were 15 men and 6 women, ranging in age from 44 to 94 years old with median age of 68 years. SBCT can manifest as an intraluminal lesion (figure 1 and 2) or as a mural mass with mesenteric extension (figure 3). In the later, the tumor presents as a spiculated mesenteric solid mass, calcified in the center, with contiguous thickening of small bowel loops (figure 4). In 19 of the 21 cases, we could see a thickened small bowel wall surrounding the mesenteric masses (figure 5). Calcification was seen in 17 of the cases and most of them were classified as coarse calcifications (figure 4 and 6).

There were 12 mesenteric masses and sizes ranged from 1 to 5 cm (median 2.9 cm). Most had well defined borders and the margins were easily outlined. In only 4 cases the margins were difficult to outline because of the radiating strands overlap. All the masses showed soft tissue strands radiating from the mesenteric masses to the adjacent small bowel walls. Radiating strands (“spoke-wheel” pattern) around the tumor represent the desmoplastic reaction and mesenteric fibrosis (figure 3, 5 and 6).

It’s common to find engorgement of the local mesenteric vessels and lymph-nodes (figure 3 and 5).

The liver metastases of SBCT have a characteristic CT appearance because of their vascularity pattern. The arterial time acquisition is essential because on early phase imaging after the administration of the IV contrast agent, the metastases enhance brightly. During venous time scan, this lesions can become isodense with the liver parenchyma and pass unnoticed (figure 7).

The differential diagnosis should include the retractile mesenteritis and treated lymphoma since they can have a very similar appearance.

Conclusion: CT is an excellent technique to show the location of the primary tumor, the involvement of the mesentery, the enlargement of the retroperitoneal lymph-nodes and the distant metastases (liver).
Ultrasonographic evaluation of Kidney Transplant

Authors: L. Nascimento, N. V. V. P. Costa, B. R. B. Leite, N. C. Ribeiro

Learning objectives: To demonstrate the role of triplex ultrasonography (TUS) in the evaluation of the kidney transplant. To review and illustrate the normal post-operative and possible complications detected by TUS.

Background: TUS is accepted as the first imaging test in the management of renal transplants, especially because it can depict and characterize many of their complications.

Findings and procedure details: On gray scale ultrasound it is evaluated renal size and echogenicity, collecting system and inspection of any post-operative collections. Color Doppler is used to evaluate global intra-parenchymal perfusion and spectral Doppler to assess flow and flow velocity measurements in the renal, iliac and intra-renal vessels. The main complications of renal transplant can be divided into parenchymal, vascular and collecting system abnormalities, and periphreric fluid collections. Pathology of renal parenchyma include acute and chronic rejection, infection, among others. TUS is not sensitive or specific on the differential diagnosis of this group of abnormalities. As vascular complications we have renal artery and vein stenosis, arterial and vein thrombosis, arterio-venous fistulas and pseudoaneurysms. TUS is of paramount importance in detecting vascular pathology. Collecting system complications include urinary obstruction and urine leaks. Fluid collections, as hematoma, urinoma, lymphocele and abscess, are easily detected by US examination although US features of this collections are often nonspecific and percutaneous aspiration is needed to warrant diagnosis.

Conclusion: TUS exhibits pivotal role in the monitoring of renal grafts, in the detection, management, and follow-up of both early and late complications.

Paediatric Chest Digital Radiography optimisation

Authors: Pedro Freitas (1), Filipa Lopes (1), Dulce Costa (2), Joana Santos (3), Graciano Paulo

Purpose: Establish local Diagnostic Reference Levels (DRLs) for paediatrics chest radiographs in order to optimise the procedures to digital radiology (DR) system.

Materials and methods: This study was divided into two phases: dose exposure retrospective analysis of chest radiographs available on Picture Archiving and Communication System (PACS) by age groups (0, 5, 10, 15 years old); and exposure parameters adaptation taking into account the age categorisation. Values of Dose Area Product (DAP-Gy.cm²), tube voltage (kV), exposure time (ms), irradiated detector area, collimated area and ionisation chamber, were collected for the 68 chest radiographs.

Results: The obtained local DRL's although similar to those found in the literature, were directly influenced by the collimation. Adjusting the tube voltage and the ionisation chamber selection allowed a mean reduction on dose and exposure time of 9% and 30%, respectively.

Conclusions: Despite the achieved reduction, optimisation of the procedure is possible, considering that exposure time value is slightly higher than the European recommendations.
Basilar tip aneurysms and fetal PCAs: do they really coexist?

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**Purpose:** Basilar tip aneurysms (BTA) are multifactorial in origin, with luminal forces playing a major role in their formation. Fetal origin of the posterior cerebral artery (fPCA) is a variant of the basilar bifurcation, present in around 20% of the population. We theorize that this variant, by diminishing sheer stress of the basilar apex wall, reduces the chances of aneurysm formation. The purpose of our study was to test the hypothesis that fPCA is less prevalent in patients with BTA then in the general population.

**Methods and Materials:** We retrospectively analyzed consecutive basilar tip aneurysms diagnosed by catheter angiography between July 2010 and January 2014. Anatomical variants of the distal basilar artery region were assessed. Descriptive statistics was used to characterize the population. A binomial analysis was used to test our null hypothesis (patients with BTA have the same prevalence of fPCA as general population). Probability value used was P=0.2 (from literature review).

**Results:** A total of 41 BTA cases were identified (N=41). No fPCA were found (x=0). We found this to be a statistical significant association with a p=0.0001. Basilar tip disposition was cranial in 43.9% and caudal in 56.1%. The most common arterial variation found was ASCA duplication (unilateral 17.1%/bilateral 4.9%).

Although we analysed a small population of consecutive basilar tip aneurysms, we found a statistical significant association

Orthopaedic surgery occupational exposure using active dosimeters

**Joana Francisco; Natália Lopes (1), Ricardo Ferreira (2), Joana Santos (3), Graciano Paulo (4),**

**Purpose:** Quantify occupational exposure on staff in the operating theatre during orthopaedic surgeries and analyse the staff radiological protection knowledge.

**Materials and methods:** This study was performed in a central hospital operating theatre. Six health professionals were monitoring during 2 months using a RaySafe i2™. The staff radiological protection behaviour was also observed. The anatomic region, type of procedure, personal shielding, personal dosimeter, staff positioning, exposure parameters and staff dose levels were also collected. To analyse the staff radiological protection knowledge a questionnaire was also performed.

**Results:** The exposure monitoring was performed in 29 Orthopaedic surgeries. The most frequent observed procedure was spine fixation (31%). The highest dose value was found for Orthopaedist 1 (17.39μSv) and the lowest exposed was the Circulating Nurse (1.11μSv). Some staff behaviour and questionnaire responses revealed lack of knowledge in radiation protection.

**Conclusions:** The staff exposure values are according to the literature, however the staff risk perception needs to be improved. Radiation protection education and training is essential to change behaviour and promote a safety culture.